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## SECTION 19

STATE WATER PLAN - JORDAN RIVER BASIN

# GROUNDWATER

**Groundwater is an important source of water for municipal, industrial and agricultural uses in the Jordan River Basin.**

### 19.1 Introduction

This section describes groundwater conditions in the Jordan River Basin. Average groundwater withdrawals (1986-1995) are currently estimated to be 134,500 acre-feet. The current developed groundwater supply is 168,500 acre-feet annually, or 26 percent of the presently developed water supply for municipal, industrial, irrigation, domestic and stock watering purposes. Groundwater in the valley's principal aquifer is generally of excellent quality on the east side of the valley, with the quality becoming poorer on the west side and towards the Great Salt Lake.

The U. S. Geological Survey (USGS), in cooperation with the Division of Water Rights, the Division of Water Quality, and the public water suppliers in the valley, is currently reporting on a study to determine the effects of groundwater withdrawals on water quality and to improve the existing groundwater model. The study was recently completed, but it is not yet published. Until this study is published, groundwater withdrawals will conform to the *Salt Lake Valley Interim Groundwater Management Plan*.

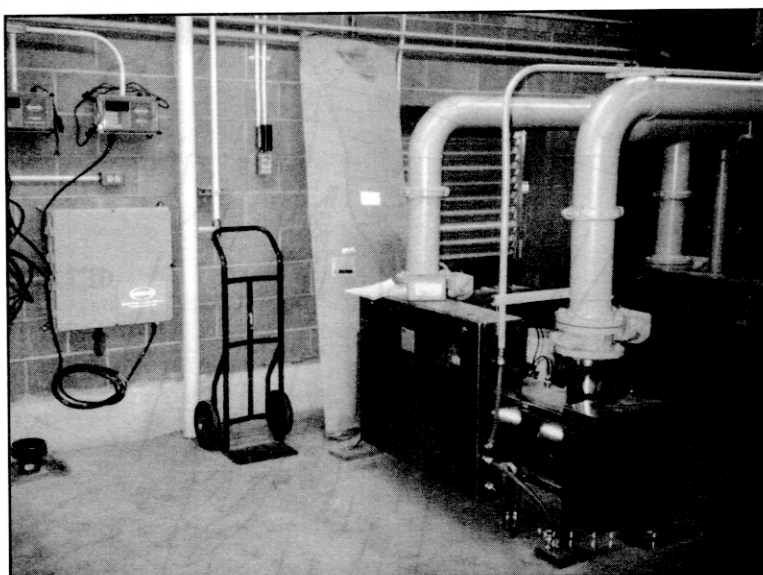
### 19.2 Subsurface Geology and Aquifer Characteristics

The Salt Lake Valley groundwater basin consists of a principal aquifer of deep, unconsolidated materials, confined by a relatively thin layer of impervious soils, which in turn is overlaid by a shallow unconfined aquifer. Figure 19-1 shows a cross-sectional view of the Salt Lake Valley groundwater regime. The confining layer of impervious soil is not continuous, more closely resembles a series of interlaced clay lenses, and does

not extend to the edges of the valley fill. Thus, near the mountain fronts, the principal aquifer is unconfined.

#### 19.2.1 Recharge

The main sources of Salt Lake Valley groundwater recharge are the Wasatch Range to the



*Ultraviolet sterilizers, Salt Lake County Water Conservancy District's Sandy Aquifer Storage Recovery System filtration building.*

east, the Oquirrh Mountains to the west and the Traverse Mountains to the south. Lateral groundwater movement, depicted in Figure 19-2, is from the mountains towards the center of the valley, then northerly to the Great Salt Lake.

Sources of groundwater recharge include: (1) Seepage from mountain bedrock, (2) underflow in channel fill of mountain streams, (3) underflow from Utah Valley through the Jordan Narrows, (4) seepage from creek channels, (5) seepage from major canals, (6) seepage from irrigated fields, (7) seepage from lawns and gardens in urban and suburban areas,

Figure 19-1  
**CROSS-SECTIONAL SCHEMATIC**  
 Salt Lake Valley Groundwater

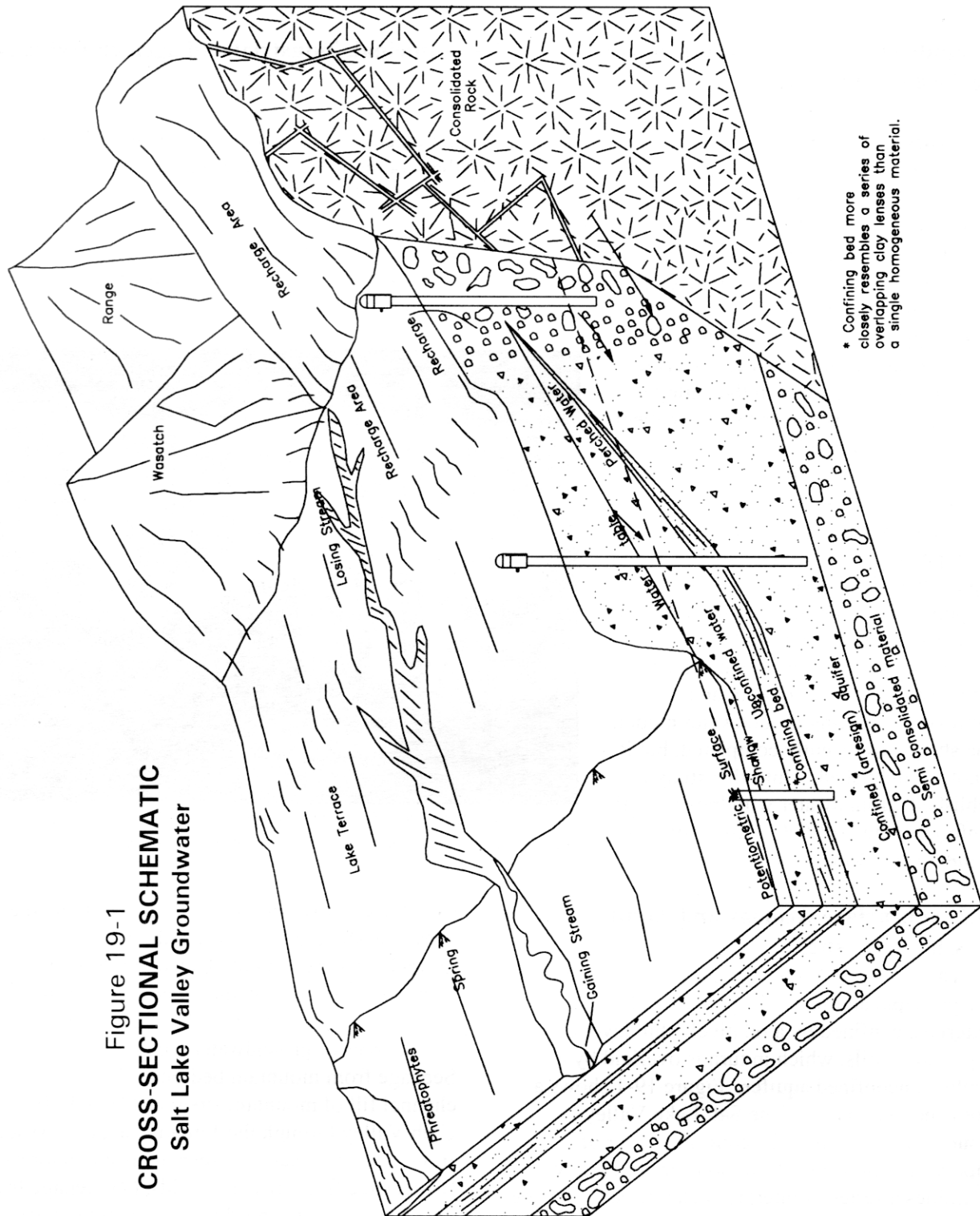
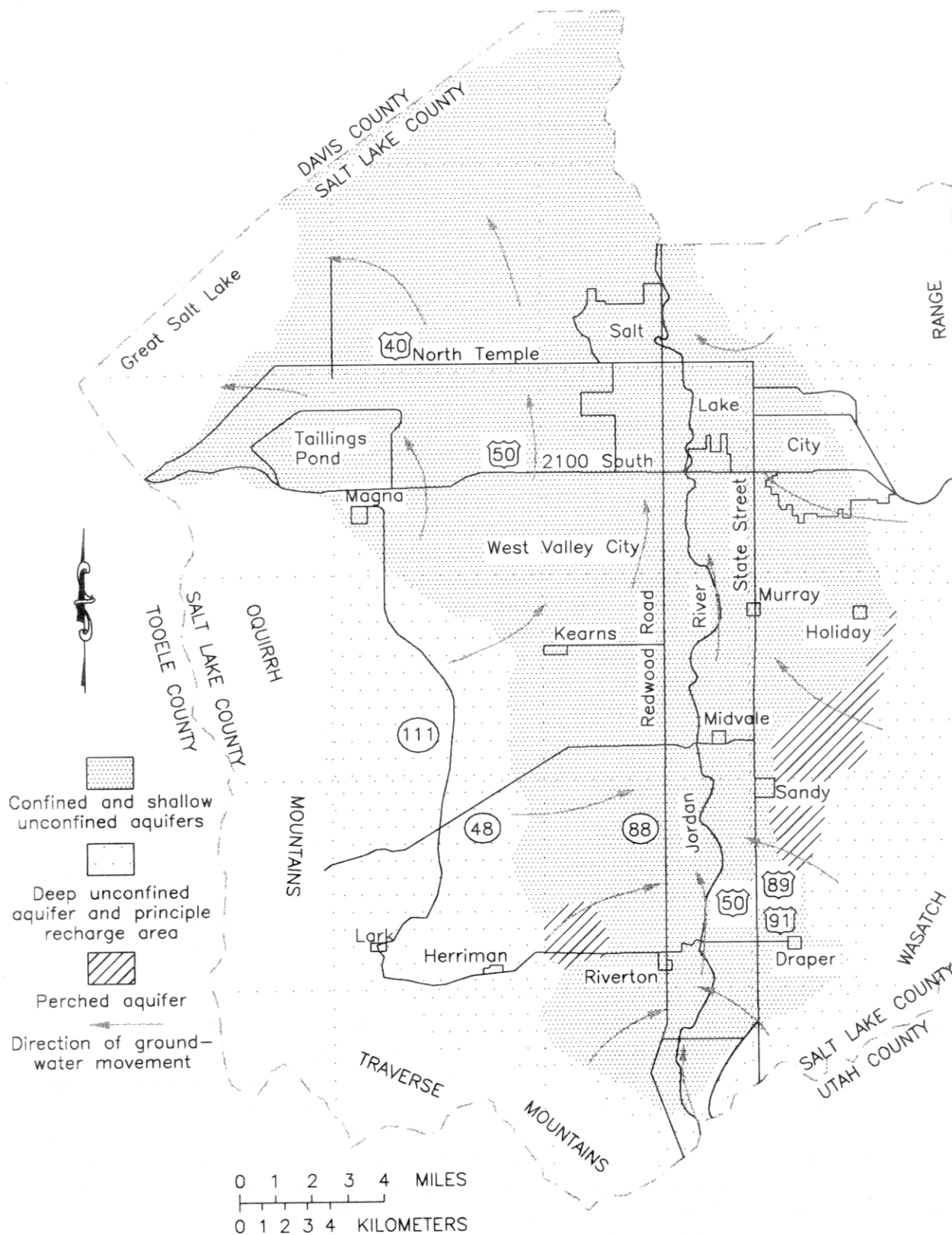


Figure 19-2  
SALT LAKE VALLEY GROUNDWATER



<p>Table 19-1</p> <p><b>SUMMARY OF GROUNDWATER RECHARGE</b></p> <p>Jordan River Basin</p>	
Source	Annual Mean (acre-feet)
Seepage from mountain bedrock	135,000
Underflow in channel fill of mountain streams	1,500
Underflow through the Jordan Narrows	2,500
Seepage from creek channels	20,000
Seepage from major canals	48,000
Seepage from irrigated fields	81,000
Seepage from lawns and gardens	17,000
Seepage from tailings ponds	2,400
Seepage from precipitation onto the valley floor	60,000
Total (rounded)	367,000
Source: Technical Publication 31: <i>Water Resources of Salt Lake County</i> , State of Utah, Department of Natural Resources; 1971	

(8) seepage from tailings ponds, and (9) seepage from precipitation on the valley floor (See Table 19-1).

### 19.2.2 Discharge

Although the deep or principal aquifer is the main source of withdrawals in the valley, groundwater is also taken from the shallow unconfined aquifer and locally from unconfined perched water aquifers. All the unconsolidated water-bearing materials in the valley are connected hydraulically to some degree. Although water in each part of the groundwater reservoir has its own important role in the hydrologic regimen, the ultimate source of most of the groundwater withdrawn is the principal aquifer consisting of the confined portion of the principal aquifer and the deep unconfined portions of the principal aquifer along the ancient Lake Bonneville benches. Withdrawals from the principal aquifer are estimated to be 168,500 acre-feet of water annually.

### 19.2.3 Water Quality

The water quality of the principal aquifer ranges from excellent on the eastern side of the valley to poor on the west. The water quality of the shallow, unconfined aquifer is generally poor. There is an upward gradient from the principal aquifer to the shallow aquifer over a large percentage of the valley. This helps maintain the high quality of the principal aquifer. Evidence indicates, however, that excessive pumping from the principal aquifer can reverse the upward gradient, allowing downward leakage of the poor quality water. This has happened locally in the

past. Several portions of the principal aquifer are susceptible to contamination if the hydraulic gradient becomes reversed for a sufficient length of time.

In low-lying parts of the valley, including most of the northern part and along the Jordan River, the potentiometric surface (level at which water will stand in an open well) for the confined aquifer is above the land surface, causing wells to flow. The confined aquifer generally yields water readily to wells. The most productive wells are around the edge of the aquifer near the mountains where it contains thick, coarse-grained deposits. Most of the least productive wells are in the northern and central parts of the valley where the aquifer consists largely of fine-grained deposits. The confined aquifer attains a maximum thickness of more than 1,000 feet in the northern part of the valley. Underlying the confined aquifer are relatively impervious semi-consolidated and consolidated rocks of Tertiary and pre-Tertiary age. The hydraulic connection between different water-bearing beds in the confined aquifer has been demonstrated many times during aquifer tests.

## 19.3 Salt Lake Interim Groundwater Management Plan

The long-range planning and management of Salt Lake Valley's groundwater aquifer will ultimately be examined once the USGS groundwater study report is published. In the mean time, it is the opinion of the State Engineer that certain actions need to be taken now to ensure the valuable groundwater resources do not become contaminated as a result of excessive

withdrawals. *The Salt Lake Valley Interim Groundwater Management Plan* was created to provide the necessary management guidelines until the USGS groundwater study is completed. The stated objective of the interim plan is to allow full utilization of the resources, within the constraint that water quality is not unreasonably affected.

The *Interim Groundwater Management Plan* divides the valley into "management areas" and sets total groundwater withdrawals from the principal aquifer in each management area, as denoted on Figure 19-3. The plan provides for further limitations on withdrawals if the cumulative effects unreasonably affect the water quality in the principal aquifer. The plan also limits applications to appropriate water from the principal aquifer to single family use (1.0 acre-foot per year) where public water systems are not available. The various management restrictions as dictated by the interim plan are represented in Table 19-2.

## **19.4 Problems and Alternatives**

### **19.4.1 Volume of Withdrawals**

One of the biggest concerns at the present time is the total volume of groundwater withdrawals. It is in the best interest of all water users that groundwater not be mined. Mining groundwater as defined herein means the withdrawal of more water than is naturally replaced over a long period of time, thereby lowering the hydrostatic water surface. Salt Lake Valley has an additional problem. Groundwater mining can potentially result in the contamination of the principal aquifer by inducing inflow of poorer quality water.

Figure 19-4 shows a summary of Salt Lake Valley well withdrawals for all uses for the 1963-1995 period. Present groundwater withdrawals of 134,500 acre-feet (1986-1995 average) are believed to be very close to the average annual yield of the principal aquifer. But there is a large amount of approved, unperfected water rights claims on Salt Lake Valley groundwater. If all are developed, total groundwater withdrawals would exceed 387,500 acre-feet, much higher than the estimated average annual recharge of the principal aquifer.

### **19.4.2 Groundwater Quality**

Groundwater contamination can be a very serious problem with potentially long-term consequences. Throughout Salt Lake Valley, many

differing types of toxic materials are stored directly on the ground or underground in containment structures. These types of facilities can and have resulted in undetected or unreported hazardous material spills. Such spills can go undetected for a considerable time while the contamination spreads throughout the aquifer. Not only is the detection of such spills difficult but the clean up can be a very time-consuming and expensive process.

Two such spills addressed in recent years are: (1) Contamination by leachate from the uranium-mill tailings of the Vitro-Chemical Co. at approximately 3300 South and 700 West in Salt Lake City, and (2) contamination of the Bingham Canyon and Bingham Creek area by seepage from reservoirs and evaporation ponds associated with Kennecott's Bingham Canyon mining activities.

The Salt Lake Valley has been divided into five general areas of susceptibility to groundwater contamination based upon geology, the rate of groundwater movement and direction of vertical hydraulic gradients. These areas are shown on Figure 19-5. Areas 1 and 2, which have the greatest susceptibility, are areas where contaminants can infiltrate directly to the principal aquifer without appreciable impediment by fine-grained deposits. Area 1 is the major recharge area for the principal aquifer with rapid groundwater velocity. An undetected spill of contaminant in Area 1 might percolate to the water table at considerable depth below the land surface and spread throughout a large area within the principal aquifer before being detected. Areas 3 and 4 are areas of intermediate to least susceptibility to contamination where the shallow unconfined and principal aquifers are separated by a confining layer, and the downward migration of contaminants is impeded by the fine-grained materials in the confining layer. Also in Area 3, the vertical hydraulic gradient is either downward into the principal aquifer or is zero. In Area 4, the vertical hydraulic gradient is upward; therefore the susceptibility for vertical infiltration of contaminants under the present hydraulic regime is zero. Within each of the four areas, the presence or absence of confining layers may cause the classification shown to be in error; therefore, it is appropriate for use only as a general guideline. Area 5 denotes the areas of transition between areas of least susceptibility to contamination and the areas of intermediate

Figure 19-3

# **SALT LAKE VALLEY INTERIM GROUNDWATER MANAGEMENT PLAN'S DESIGNATED MANAGEMENT AREAS**

Withdrawal limits  
(acre-feet)

1		124,800	6		33,000
2		7,500	7		18,000
3		14,000	8		13,000
4		3,000	9		20,000
5		700			Restricted Pumpage

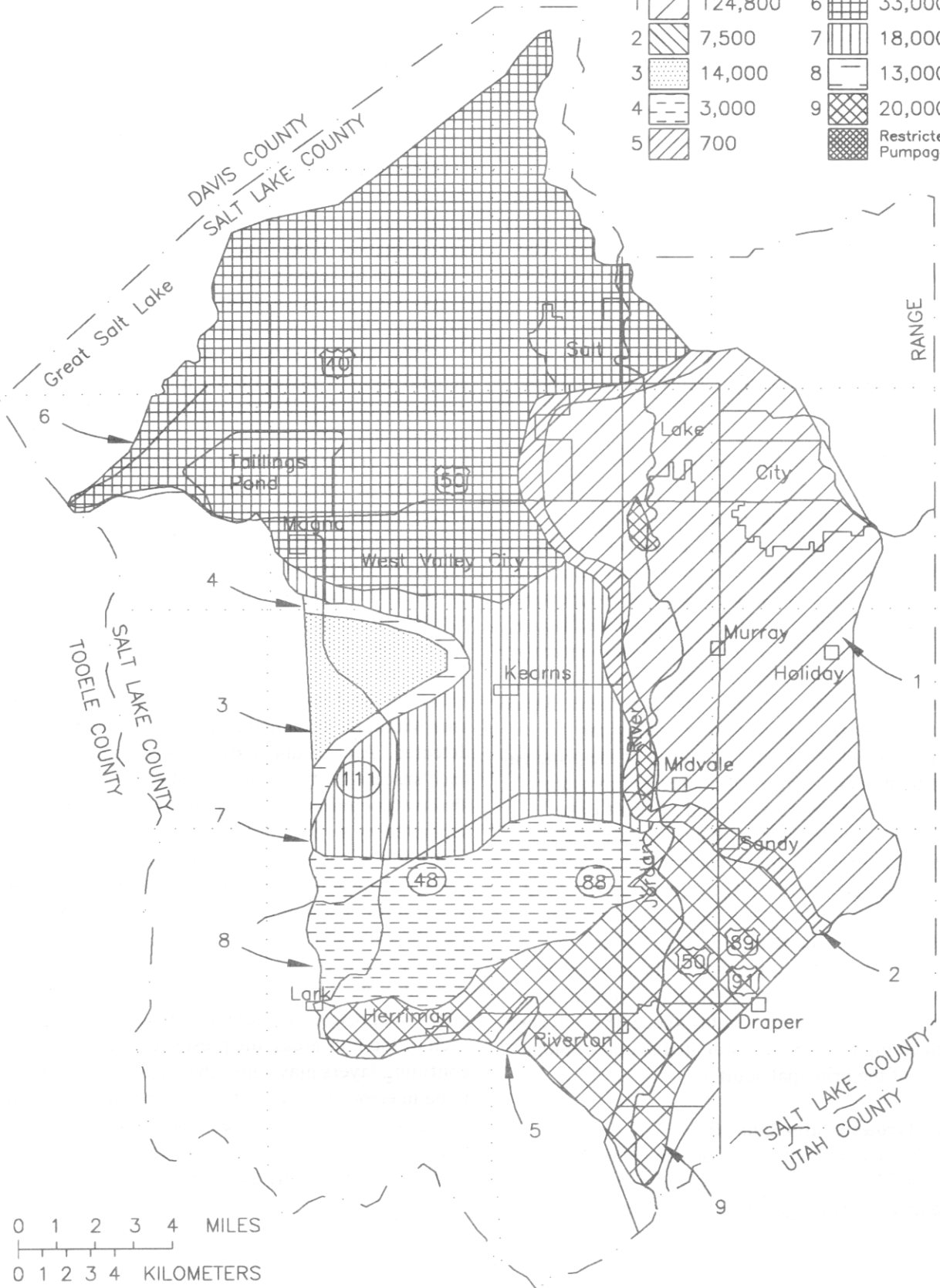


Figure 19 - 4

# **SALT LAKE VALLEY ESTIMATED WITHDRAWAL FROM WELLS**

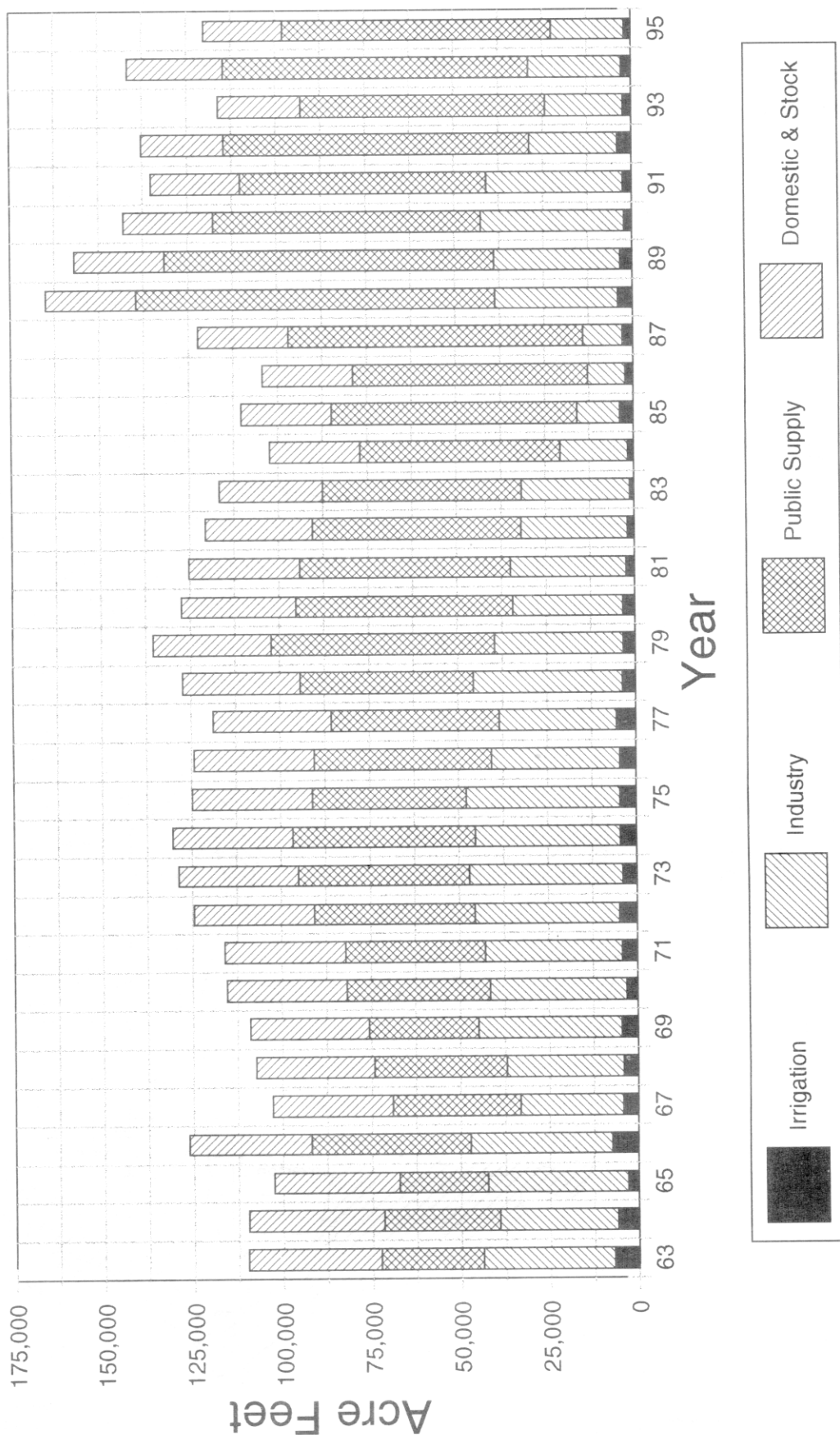


Figure 19-5  
**AREAS OF DIFFERING SUSCEPTIBILITY  
 FOR CONTAMINATION OF WATER  
 FOR SALT LAKE VALLEY  
 PRINCIPAL AQUIFER**

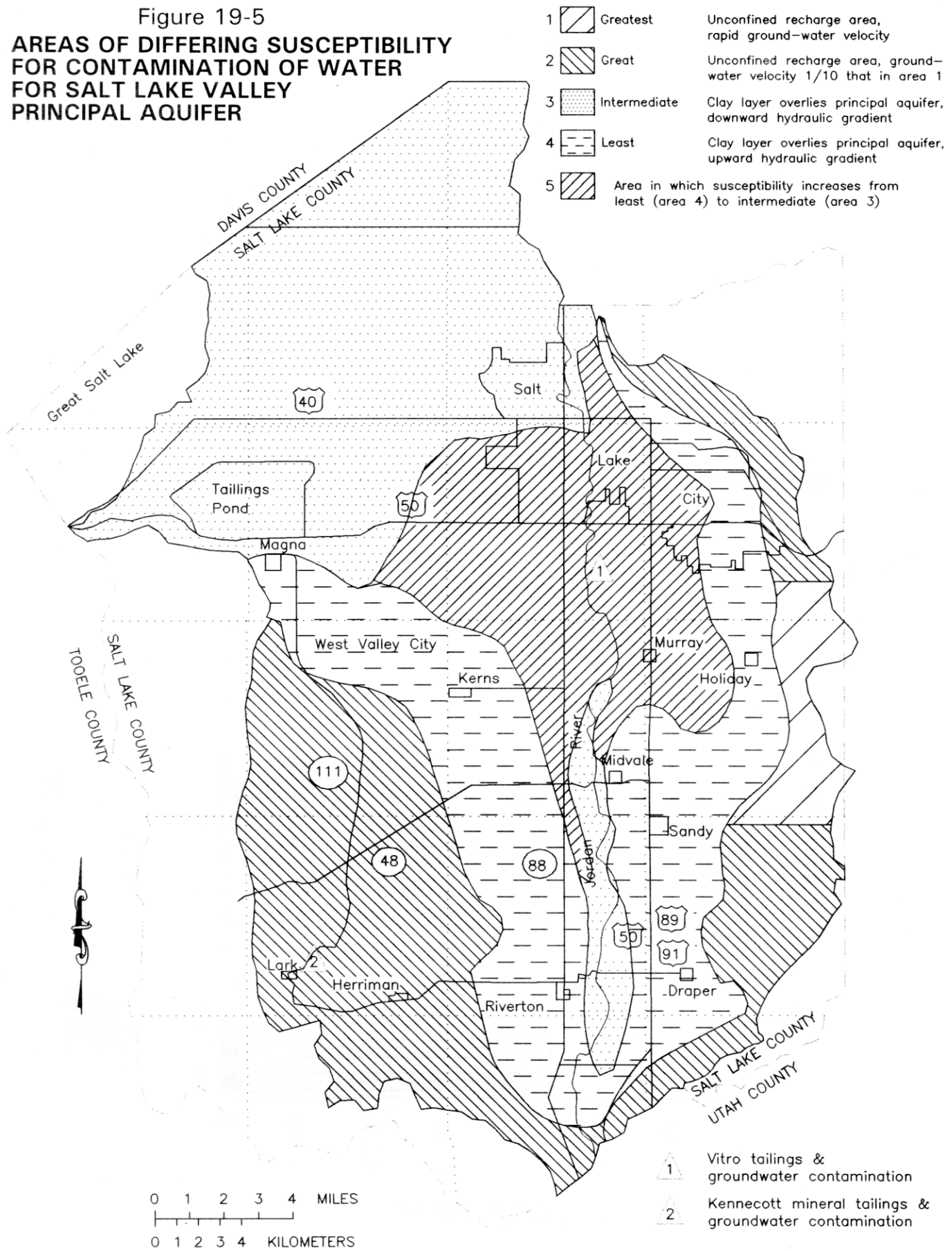


Table 19-2  
**INTERIM GROUNDWATER MANAGEMENT PLAN SUMMARY**  
Salt Lake Valley

Item	Limitation
Withdrawal Volume	<ul style="list-style-type: none"> <li>• Total annual groundwater withdrawals will be limited to predetermined amounts based upon valley location.</li> <li>• Cumulative effects of withdrawals on quality and quantity will be considered.</li> <li>• Isolated wells may be approved regardless of total area or valley-wide withdrawals.</li> <li>• Shallow aquifer withdrawals above the recommended valley-wide limit may be authorized as long as no adverse effects are noted on other water rights.</li> </ul>
Applications/ Segregation	<ul style="list-style-type: none"> <li>• Limited rights (less than 1.0 ac-ft/yr) may be approved for single family use when a public water supply system is not available. These rights are renewable on a 10-year basis as long as no public water supply system is available at the time of extension.</li> <li>• Segregation will be reviewed according to their individual merits.</li> </ul>
Time Extensions	<ul style="list-style-type: none"> <li>• Extensions required due to unjustified delays or lack of diligence may be subject to a reduction in water right quantity, a reduction in the priority date or a denial of the extension of time request.</li> </ul>
Change Applications	<ul style="list-style-type: none"> <li>• Change applications will be considered based upon their individual merits which will now also include water quality.</li> <li>• Change applications proposing to transfer rights from the shallow to principal aquifer will not be approved.</li> <li>• Changes from a management area of poorer quality to a management area of better quality will not be approved.</li> </ul>
Proof of Appropriation/ Change	<ul style="list-style-type: none"> <li>• Only that amount of water that has been developed and placed to beneficial use can be certificated.</li> </ul>
Well Spacing/Flow Rate	<ul style="list-style-type: none"> <li>• Total groundwater declines or impacts on adjacent rights with an earlier priority date shall not exceed 12 feet.</li> </ul>
Metering	<ul style="list-style-type: none"> <li>• All wells capable of withdrawing in excess of 50 acre-feet per year will be equipped with an instantaneous flow and total volume meter.</li> <li>• All wells capable of withdrawing in excess of 250 acre-feet per year shall also submit an annual water quality report for total inorganics.</li> <li>• Water level data are also requested if available.</li> </ul>
Reporting	<ul style="list-style-type: none"> <li>• All wells capable of withdrawing in excess of 50 acre-feet per year shall submit to the State Engineer an annual report stating the total amount of water withdrawn for the year.</li> </ul>

susceptibility. Change applications that consider moving water to a better quality zone will not be approved by the State Engineer.

The extent of contaminated groundwater in the Salt Lake Valley ranges from areas of less than 0.1 square mile to areas greater than five square miles. The contaminants include organic and inorganic constituents. Some have infiltrated only to the shallow unconfined aquifer, whereas others have

caused deterioration of the water quality in the principal aquifer. Organic chemicals were detected in water from several wells completed in the shallow unconfined aquifer with the greatest concentrations near landfills or tailings areas. The greatest concentrations of trace elements in water in the shallow unconfined aquifer were from wells near landfills or tailings areas. ■